

Design and Development of a Compact and Rugged Phase and Fluorescence Microscope for Space Utilization, Phase I

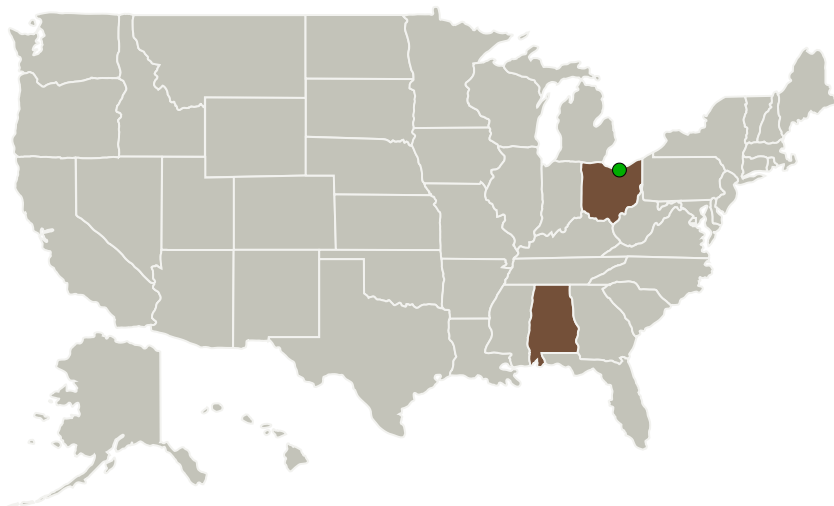
Completed Technology Project (2013 - 2013)



Project Introduction

In this SBIR Phase 1 we propose to develop a novel microscope by integrating Fourier phase contrast microscopy (FPCM) and epi-fluorescence microscopy. In FPCM, the high degree coherence of low power laser source provides well resolved spatial frequency bands in the Fourier plane and the retardation is generated by photo-thermally induced phase transitions in a liquid crystal by varying the intensity of the laser. Further the controlled phase shift induced by the liquid crystal cell will be utilized for quantitative phase imaging. On the whole, the system offers simultaneous recording of Fourier phase contrast and epi-fluorescence images shot at the same time (at the speed of the camera). Similarly it is also possible to perform simultaneous quantitative phase and epi-fluorescence imaging in real time. The proposed microscope offers several unique advantages over the commercially available state-of-the-art technology. Our system is physically robust, user friendly, maintenance free, with no moving parts and frequent alignment, consuming minimum power. The modular system built with inexpensive optical components is versatile. It will be extremely useful in the biological and biomedical research labs. The system can be conveniently installed in International Space Station for high throughput live cell imaging.

Primary U.S. Work Locations and Key Partners



TASK	Period of performance			
	1-2	3-4	5-6	
Task 1A: Design and Development of prototype	80%	10%		
Task 1B: Optimization and performance studies of the prototype	30%	50%		
Task 1C: Testing and optimization at the research and teaching facilities		30%	80%	
Task 2: Development of quantitative phase microscopy using FPCMOM			50%	10%
Task 3: Testing of microfluidic based cell flow system and demonstration of quantitative phase measurements			70%	30%
Task 4: Preliminary design of phase II high throughput and compact system for orbital spacecraft or space station				
Reporting				

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Organizations Performing Work	Role	Type	Location
East West Enterprises Inc.	Lead Organization	Industry Minority-Owned Business, Small Disadvantaged Business (SDB), Women-Owned Small Business (WOSB)	Huntsville, Alabama
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations

Alabama	Ohio
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Project Transitions

**May 2013:** Project Start**November 2013:** Closed out

Closeout Summary: Design and Development of a compact and rugged phase and fluorescence microscope for space utilization, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image(<https://techport.nasa.gov/file/138081>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

East West Enterprises Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

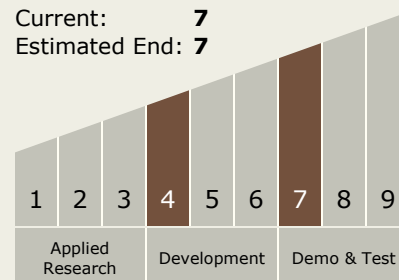
Carlos Torrez

Principal Investigator:

Ramarao Inguva

Technology Maturity (TRL)

Start: 4
Current: 7
Estimated End: 7

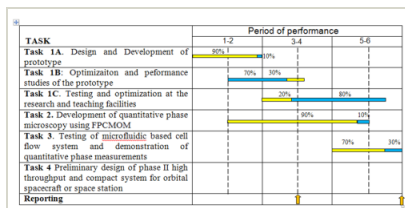


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Images



Briefing Chart Image

Design and Development of a compact and rugged phase and fluorescence microscope for space utilization, Phase I
(<https://techport.nasa.gov/image/129129>)

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.3 Optical Components

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System